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ABSTRACT

An introductory computer literacy curriculum for teachers and administrators developed by the Science Teaching Centre of the Department of Education at Tel Aviv University covered four major topics: (1) The Information Society; (2) Computer Aided Learning; (3) Computer Languages and Education; and (4) Implementation of Computers in Schools--A Practical View. The final section of the unit provided a summary and discussion of the material covered. The 60-hour course consisted primarily of lectures, although 12 hours were devoted to hands-on interaction with an Apple II+ microcomputer. The syllabus and learning materials were first tried in an experimental full-credit academic course during the academic year 1981/1982. Based on an evaluation of the course, the curriculum was revised in two versions, one for teachers and the other for educational decision makers. The following year the revised versions were tried out as an academic course with 40 students, and as an intensive extracurricular course for major decision makers in the Israeli education system with 50 participants. Evaluations showed both an increased interest on the part of the participants in computer technology, and a more realistic appreciation and critical judgement on their part of the process of implementing computers in education. A 14-item bibliography is provided. (EW)

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UNIT FOR COMMUNICATION & COMPUTER RESEARCH IN EDUCATION היחידה לחקר תקשוב בחינוך

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THE DESIGN AND IMPLEMENTATION OF AN INTRODUCTORY COMPUTER LITERACY COURSE FOR TEACHERS AND EDUCATIONAL DECISION MAKERS

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1. INTRODUCTION

For many years, education remained a subculture within a technological society (4). The main processes with which education is engaged, namely information production and dissemination, remained, in principle, human based processes, supported only by 15th centry print technology. The major technologies developed during the industrial revolution were concerned mainly with Energy Conversions, and exerted profound social changes (10). Yet those technologies bore no relevance to teaching and learning. The appearance of information technologies, mainly the availability of microcomputers (1,6), have brought about a technology which is finally relevant to the process of education. Therefore for the first time the education system will face the real challenge of joining the 20th century technological culture (3,12).

The introduction of computers into the education system will probably follow in the footsteps and pitfalls of an organizational change, resulting from implementing other innovative technologies (11). One of the conclusions from similar situations is that change has to be carefully planned, introduced and implemented (7,9).

An essential measure which will have to be taken is that of creating that of awareness of the innovative technology to be implemented: its scope, basic concepts, capability and limitations. The human factor is probably the pre-eminent element of the infrastructure of the education system and therefore, even before we have a definite answer to the many problems arising from the merging of information, technology and education, we have to start by creating computer literacy among teachers, educators and educational decision makers.

The implementation of computers in the Israeli education system during the last few years follows the uncontrolled model (13) fastered by commercial computer companies and other interest groups. In most cases, teachers and educators are not prepared for the computer age and its implementation. Some teachers resent the use of computers in education. They often claim that, "while using computers in the learning process we will lose essential human contact"; or "computers will replace teachers and dehumanize the education system" (8,14). Other teachers are very enthusiastic about the potential use of computers in the classroom, and have high expectations regarding the new electronic innovation; however, at the same time, they lack a realistic view of the complexity of its implementation.

Rapid introduction of computers into the education system without any planning or preparation may, in the long run, disappoint these teachers and make them reject the technology. Therefore, we find teacher-training one of the most important and essential aspects that must be dealt with.

In the present paper we describe the specific nature of just such an effort that we have undertaken at the Science Teaching Centre at the School of Education at Tel Aviv University. We present the development of an introductory Computer Literacy course for teachers and for educational decision makers.

A description of its objectives, content and instructional methods will be given, and the impact and the effect of the training on both teachers and educational decision makers will be discussed.

2. CURRICULUM DEVELOPMENT

On the basis of forecasting the future use of computers in schools, (2,5) the Science Teaching Centre at the School of Education at Tel-Aviv University started at the beginning of the year 1981 to develop an introductory computer literacy curriculum for teachers and educators. The syllabus and the learning materials developed were first tried in an experimental, full-credit academic course during the academic year 1981/1982.

Considering the achievements of the participants, their needs and interests as reflected from formal evaluation of the course, direct feedback and observers' judgement, in addition to comparitive analysis of similar courses given in other institutions, the curriculum was revised in two versions: one for teachers and the other for educational decision makers.

Each of the two versions gave emphasis to different academic content and skills but shared the same goals and syllabus. In the academic year 1982/1983 the revised versions were tried out as an academic course (40 students), and as an intensive extracuricular course for major decision makers in the Israeli education system (50 participants).

3. COURSE DESIGN

3.1. Goals

The following goals were set for the computer literacy course:

1. Understanding that computers are part of the "information revolution" and not a passing fashion.
2. Understanding that information technology provides for the first time in the modern history of education an appropriate and relevant technology.
3. Defining a realistic estimate of the capabilities and constraints suggested by applying computers to education.
4. Presenting the diversity of the use of computers in education.
5. Acquiring basic concepts and skills concerning the use of computers in education.
6. Creating positive attitudes towards computers by developing a sense of control of a computer and demystification of the technology.
7. Developing judgement skills for decision making concerning hardware and software utilization.

3.2. Syllabus

PART 1: THE INFORMATION SOCIETY

1.1. Origin and Nature of Information Technology (2 hours).
An anthropological view of technology as part of mankind's cultural evolution, with special emphasis on information technology. The emergence of early systems of symbols followed by the invention of writing and number systems. The invention of printing and technology. The development of computing machines, from mechanical to electronic computers. The merging of computer systems with communication networks to create a communication technology which can process alpha-numeric, visual and acoustic information.

1.2. The Social Implications of Information Technology (2 hours).
The scientific revolution and the information explosion. Economical parameters of information changes and occupational profiles. The many uses of computers - home, work, commerce, entertainment, education, communication and social centralization and decentralization. The potential for participative democracy, ethical issues, the individual and society in the information age.

1.3. Computer Technology (4 hours).
The history of the electronic computer from the vacuum tube to the chip. Input - processing - output. The binary code and a representation of symbols in a computer (Bit, Byte, K-Byte, M-Byte) the difference between main frame, mini and microcomputer. The microcomputer components, CPU, I/O devices memory (ROM, RAM, PROM), peripherals. The usage of microcomputers. Initial hand-on-experience using computers.

1.4. The Relevance of Information Technology to the Education System (2 hours).
The major problems faced by the education system: its magnitude, the vast amounts of information to be delivered and disseminated and the inefficiency in catering to the diversity of the student population. Education operates as a non technological organization; however, information technology is, for the first time offering a breakthrough in handling the major problems encountered. Each problem area is discussed.

1.5. A general overview of the Potential use of Computers in Education (2 hours).
The computer as subject matter:
The computer as an Instructional Aid (CAI).
The computer as a management tool (CMI).
Using information technology to enrich the learning environment.
The computer as a problem solving aid.

PART 2: COMPUTER AIDED LEARNING-CAL

2.1. Computer Assisted Instruction (CAI) (6-8 hours).
Basic concept and structure. The place of CAI in the curriculum. Drill and practice and tutorial systems. Description and demonstration of CAI systems: "TOAM", "MASKOV", "SEMEL", "MACAL", and PLATO.

2.2. Intelligent CAI (ICAI) (2-4 hours).
Description and demonstration of ICAI systems. The advantage of simulation as a teaching aid. Motivating educational games.

2.3. Software and Courseware Design and Evaluation (4-6 hours).
The software and the curriculum issue. The theory of programmed learning and modern learning theory. Basic concepts of software design. Some criteria of courseware evaluation. Workshop - acquaintance with and evaluation of educational software.

2.4. Computer Managed Instruction (CMI) (2 hours).
CMI in a macrosystem.
CMI of the CAI - controlling the information flow in a classroom.
Modelling the student - diagnostic programs.
Information sources and information receivers in an educational system.
Repetitive behavior that lends itself to automation. Levels of decision making in education. Data generating and processing at school management level.

2.5. Using Information Technology To Enrich the Learning Environment (2 hours).
Technologies: data bases, electronic library, video disk, communication network, teletext, view data.

The individual and the learning environment. Classroom school community and the new learning environment.

PART 3: COMPUTER LANGUAGES AND EDUCATION

3.1. Man-Machine Communication (2 hours).
Basic concepts of communicating computers. Operating system. Computer languages - the assembly language and high level languages. Authoring languages, Compilers and interpreters.

3.2. Basic BASIC (6-8 hours).
Basic concepts of computer programming in BASIC. Workshop, how to write and run very simple programs (mainly graphics).

3.3. LOGO (4-6 hours).
Papert's education philosophy of LOGO. The structure of the LOGO computing language. Expectations and practice in the use of LOGO. A short workshop on LOGO.

PART 4: IMPLEMENTATION OF COMPUTERS IN SCHOOLS: A PRACTICAL VIEW

4.1. Implementing Computers in Schools (2 hours).
Introducing an innovative technological change. Hawthorn effect and resistance. Grassroot vs. central strategies of implementation. Hardware constraints, human constraints, economical constraints and the software constraint. Changing the school into a technological organization.

4.2. Configuration of Computer Systems in schools (2 hours).
Introducing computers into the existing school structure: the logistics and maintenance, central laboratory and learning centres, interweaving into the existing curriculum. Individualizing instruction. Coordinating CAI and CMI. Stand alone systems, hard discs and network configurations.

4.3. Cost-effectiveness of using computers in education (2 hours).
The problem of estimating quantitative educational output. The changing cost of hardware and software. Main frames vs personal computers, analysis of special needs.

4.4. Computers: Special Technology for Special Children (2 hours).
The gifted; the handicapped; the low achievers; those with impaired hearing; the blind; special interest groups.

4.5. The Computer in Informal Education (2 hours).
The computer as an information resource. Using networks in a community infrastructure. Computers for leisure. The electronic library and view-text educational services. Computers and the creative arts. Individualized vocational training. Communication and cooperation across geographical barriers for educational purposes.

PART 5: SUMMARY AND DISCUSSION (4 hours).
TOTAL (60 hours).

3.3. Instructional Methods

3.3.1. Lectures

Most of the course lectures, which were presented in the traditional frontal situation, were enriched by video-tape films and examples of educational software and courseware on a large monitor screen.

3.3.2. Hands-On-Experience Workshop

The hands-on experience workshop consisted of interaction in an APPLE II+ classroom for about 12 hours (out of 60). This included computer usage, introduction of educational software and courseware samples and first steps in computer programming (mainly short graphics programs that require minimal mathematical background). The students were given the opportunity to spend some of their free time in the computer classroom.

Both types of computer communication were necessary: allowing participants to run prepared programs gives them the opportunity to feel and understand the complexity of computer software, as well as an understanding of how simply the computer can be used; the first steps in programming convey the idea that the humanbeing is controlling the computer, and not vice-versa. It is also emphasized that everyone can do simple programming.

3.3.3. Visits

Two fields visits were made to schools and CAI Research and Development centres.

3.3.4. Bibliography

In the academic course there were three kinds of reading material.
a) A collection of articles, two for each part of the syllabus, that were chosen as a compulsory bibliography.
b) Some reputable books and articles suggested as additional reading.
c) Literature pertaining to specific subjects of the final project.

3.3.5. Final Project

Each group of students was required to do an active study by working on a "final project".

Some general subject areas were suggested:
a) The computer and special education.
b) Evaluating the implementation of the CAI system in an Israeli school as a case study.
c) The computer in teaching various disciplines.
d) The process of teaching programming and computer literacy in schools.
e) Evaluation of some ICAI software and systems.
f) Software development.
g) Open subject for students' suggestion.

4. DISCUSSION

While we consider our observations and conclusions as still preliminary, at this stage they serve as a good basis for further development.

In an overall impression the course, we see an increase in the interest of most participants, realizing the fact that we are now facing a technological innovation which is relevant and appropriate to the education system. Most of the students feel that the technology is not sufficient to ensure an educational breakthrough. Only careful design and controlled implementation will realize the potential of the technology.

The growth of interest and the transition from naive enthusiasm to a realistic appreciation and citical judgement of the process of implementing computers in education, were evident both in students of education and education decision makers.

Many of our students have enrolled in advanced courses, and unexpectedly large numbers of them have sought further personal guidance for M.A. theses and special projects. Most of the student's final projects attacked essential problems critically and constructively.

A more accurate evaluation can be made with respect to the decision makers. A revised policy, undertaken after the seminar, reflected a change from short-range concern in purchasing hardware and technical details to long-range planning of the implementation process, its experimental control and its careful dissemination. The second trend is the transition from a passive decision-making approach towards and active one.

Only long range observation and research will enable us to study the full effect of the course on the implementation process. We can only say that the revised syllabus and the recommended instructional methods will now be used on an extended scale, and by 1985 will become a compulsory course for all students at the School of Education. At the same time, an adapted version will be used for teachers in service training by the Department of Further Education.

We can only hope that this course will contribute towards a rational, human introduction of the technology into the education system.

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